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THE AMERICAN METEOROLOGICAL JOURNAL.

A MONTHLY REVIEW OF METEOROLOGY.

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THE AMERICAN

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VOL. XII. BOSTON, MASS., SEPTEMBER, 1895. No. 5.

EDITORIAL NOTES.

THE vacancy caused by the removal of Prof. Mark W. Harrington, as Chief of the Weather Bureau, has been filled by the appointment to that position of Prof. Willis L. Moore, lately Local Forecast Official at Chicago. Prof. Moore entered the Signal Service School at Fort Myer, in 1876, and ranked second in a graduating class of thirty members. In 1886 he was made a sergeant on account of his having devised certain improved methods of issuing the daily weather forecasts and maps. After being stationed at Chicago, Ill., and Albany, N. Y., Prof. Moore was transferred to the Central office in Washington, where he remained till 1891. In that year he was transferred to Minneapolis, Minn., and later to Milwaukee, Wis., at which places he was Local Forecast Official and Director of the State Weather Services.

During the past year, Prof. Moore entered the competitive examination for a professorship in the Weather Bureau, and attained the highest rank among the ten candidates who had stood best in the examination and were therefore selected to compete in practical forecasting. His attainment of this rank gave him the professorship. Since his appointment as professor, the present Chief of the Weather Bureau has been Local Forecast Official at Chicago, Ill., where, during the past winter, he made a very fine record in his cold wave forecasts.

IN view of some misunderstanding regarding the editorial in the last JOURNAL, on the removal of Prof. Harrington, it may be

here stated that neither Prof. Cleveland Abbe nor Mr. Oliver L. Fassig saw the editorial before publication, and that they were not responsible for it.

WE wish to call the attention of the readers of this JOURNAL to the notice concerning the Zi-Ka-Wei Meteorological and Magnetical Observatory, printed in our August number. This observatory has, since its foundation in 1873, done a work of which any institution might be proud, in issuing meteorological charts, bulletins, and storm warnings, keeping hourly magnetical and meteorological records, and publishing investigations of various subjects in connection with meteorology and terrestrial magnetism. Father Chevalier, the director of the observatory, is an indefatigable worker, and a thorough enthusiast. We have had occasion, during the past three years, to notice his active interest in forming the Shanghai Meteorological Society, and in preparing and publishing, as president of that society, reports on the typhoons of the China seas and on fogs along the northern coast of China.

It is now Father Chevalier's wish to secure for his observatory an equatorial telescope, in order that valuable astronomical work may be carried out. In order to buy this instrument he needs money, and he has therefore sent out an appeal to those who are interested in the science and in his work for funds. Father Chevalier has written to ask us to bring his appeal to the notice of our readers, a request which we are very glad to carry out. The rate-payers of the English settlement and the municipal Council of the French settlement of Shanghai, each granted a sum of £400 to Father Chevalier, and no better indorsement of his work is needed than this. We feel perfectly sure that any money sent to Father Chevalier will be wisely spent.

SYNCHRONOUS OR SIMULTANEOUS GEOGRAPHICAL DISTRIBUTION OF HOURLY WIND VELOCITIES IN THE UNITED STATES.*

FRANK WALDO, PH. D.

THE representation of the synchronous wind velocities over a continent (*i. e.*, from sea to sea) is given on the daily weather maps for specified hours for the individual days. The material accumulated by the U. S. Weather Bureau allows the average velocities for a number of years to be so charted for successive hours, thus furnishing an opportunity to note the gradual effect on surface wind velocities of the gradual heating up of a continent. This could not be done in a complete manner in the present investigation, and it has been necessary to select a few of what may be regarded as the most prominent features for presentation.

For the extreme months of *January* and *July*, and for the *year* (not given here), the wind velocities at 0 or 24h. (midnight), 6h., 12h. (noon), and 18h. of about the 97th meridian time have been charted and the lines of equal wind velocities drawn. The 97th meridian was chosen as being at about the centre of the continent, and the times were selected so as to show, at 0h., the condition when the sun was twelve hours distant from this meridian, influencing as little as possible the air mass ; at 6h., the condition when the sun's rays are touching the eastern part of the continent ; at 12h., the condition when the sun is over the centre of the continent ; and 18h., the condition when the sun's rays are mainly confined to the western part of the continent. Only the midnight and mid-day charts are reproduced here for the sake of brevity.

A complete representation of the characteristics of these charts would require a lengthy text ; but the charts themselves will offer an opportunity for obtaining a comprehensive view of the synchronous wind conditions and relations as regards the average velocities.

*A portion of a memoir prepared for the U. S. Weather Bureau, and printed by permission of the proper authorities.

But one point will be taken up for further presentation just now, and that is the absolute increase (or decrease) in the wind velocities at 6h., 12h., and 18h. of the 97th meridian time above that observed at midnight. In order to present this in the clearest manner, auxiliary charts have been prepared, on which has been shown this increase (or decrease) in miles and tenths per hour. These latter charts show the changes in the wind velocities which have been necessary to produce the conditions shown in the successive charts showing wind velocities and counting always from the condition at midnight as a standard for reference.

It would have been desirable to also express changes in percentage of actual wind velocities, rather than *absolute values*, but in a first work of this kind one is not always sure that the method adopted is the best or proper one, and so this second step has not been carried out. When thinking over the arrangement of this section, it seemed best to adopt midnight as a standard of reference, but after the charts were drawn it appeared possible that an hour more nearly corresponding to the time of principal minimum of wind would have answered better.

JANUARY. The synchronous wind velocities at midnight of 97th meridian time as shown on *Chart I.* may be characterized as fllows: o on the eastern and western ocean coasts, excessive velocities in the north of 16 or 17 miles per hour for exposed stations, decrease with the latitude to 4 to 6 miles per hour at the south for poorer exposures. On the Great Lakes the wind velocities range from 11 to 13 miles per hour, and on the Gulf of Mexico from 10 to 11 miles per hour. Inland on the Great Plains there is a narrow maximum region extending from north to south, and the velocities of 8.5 or 9 miles per hour in the north increase to 10.5 in the south.

To the eastward and westward of this maximum region the velocities decrease, so that the lines of equal wind run nearly north and south, but the recurrence of larger velocities in the region of the Great Lakes causes an east-westerly direction for the lines in the northeast United States, and a southwest-northeasterly direction in the southeast United States. The principal minimum region of the west has 4 or 5 miles per hour of wind and in the east 5 or 6 miles per hour of wind with minor regions of lesser values. High exposed anemometers at some

isolated stations in various parts of the United States show velocities of from 10 to 12 miles.

While *Chart II.* shows the conditions at the midday hour, yet these characteristics will not be further dwelt on, but the changes which the conditions shown on the midnight chart have undergone, in order to reach the conditions represented on the 6h., 12h., and 18h. charts will be spoken of. These are in turn most clearly seen by examining the charts.

Chart III. shows the changes that have taken place from midnight to 6h. The figures attached to the curves show the increase of the wind velocities in miles and tenths, and a negative sign indicates a decrease where such a change occurs.

On the Atlantic coast there is a decrease in the wind velocity, although it becomes numerically less toward the south, and for the Carolina coast the direction of change is even reversed, and a very slight increase in the wind is noticeable. On the Pacific coast the slightest possible decrease in the north changes to an increase at the centre, .4 miles per hour, and a slight increase continues to the extreme south. On the Gulf coast there is a decrease of —.2 in the eastern part, no variation at the centre, and a decrease of —.6 at the west; consequently in the main a decrease toward the west. For the Great Lakes there is a slight increase in the east of .1, but with westward progress this disappears; and for the Upper Lakes there is a decrease, which continues to become numerically greater until it reaches —.7 at the western end of Lake Superior.

Inland there is a decrease, —.4 or greater, along a narrow region on the lower, and a wide region on the upper, Mississippi River Valley. For the Great Plains, in the north, there is an increase, —.4 or more; at the south there is little change, .0; while in the extreme southwest there is again a decrease, —.6. East of the Mississippi River Valley there is at first a region of no change along the 87th meridian, and then in general an increase from .2 to .5, although in Central Tennessee there is a small region of decrease, —.3. West of the 100th meridian there is an increase of .2 to .5, in the central part, and a decrease reaching —.5, in the northern, and a decrease ranging from —.1 to —.9, in the southern portions.

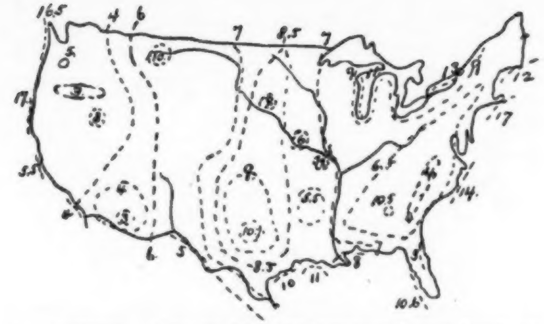
Chart IV. gives the changes from midnight to 12h. (noon), and shows an increase over the whole country except on the

Atlantic coast, where, for the exposed stations, there is a decrease of —.7 at Block Island and a constant wind at Hatteras; on the north Pacific coast where there is a decrease, —.5, as also at Helena —.5, and in the central Mississippi River Valley, where there is no change, .0. There is a much stronger marked general increase with decrease of latitude (except for the Mississippi River Valley) than was noticeable for the interval 0 to 6h., but there are only slight differences for the lower Mississippi River Valley and for the few exceptionally high exposures of anemometers. The absolute increase over the period from 0 to 6h. is about 1.5 miles per hour in the northern and perhaps 2.5 in the eastern United States (except on the coast where it is less); about 1.5 in the northern to 2.5 or 3.0 in the southern part of the central United States; and perhaps .5 in the northern to an amount varying from .0 to 6.0 in the southern part of the western United States. On the whole, the increase from 0 to 12h. over that from 0 to 6h. would be, perhaps, 2.5 miles per hour. The uniformity of increase on the eastern and western Gulf coast is remarkable (a little over 1.0).

Chart V. shows the increase in the wind velocity from 0 to 18h., and presents not only a diminution in the amounts for the period 0 to 12h., so that again negative values are common, but the relative amounts are also different and even more variable than for the period 0 to 6h. On the exposed Atlantic coasts there is a common slight decrease of —.4 at the north and centre, although there is a slight increase at the poorer exposed coast stations, varying from .1 in the north to .6 in the south. For the Gulf the average increase would be but about .2; while for the Great Lakes there is in general an increase, but cases of decrease also occur. On the Pacific coast there is an increase at the north, .6, which becomes still greater with southward progress, being 3.5 at the centre and 2.5 for poorer exposure at the extreme south.

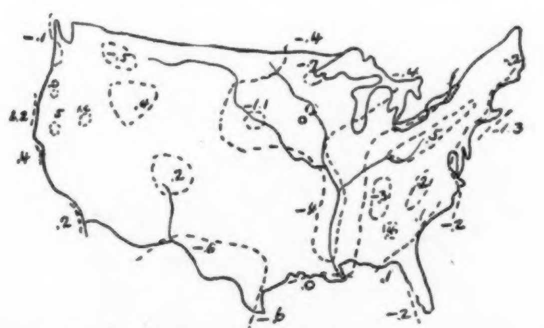
Inland on the Great Plains the increase ranges from .2 to .6, but there are cases of decrease. To the eastward of this, along the Mississippi River Valley, there is a decrease reaching —.9 for the central part, in the extreme south no change, .0, and in the north an increase of .6. Farther east there is an average irregular increase of perhaps .5.

To the west of the Great Plains there is a general increase,

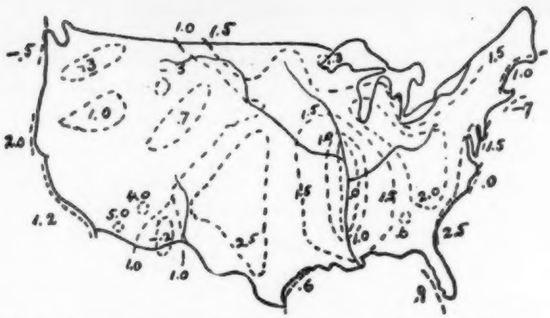


I. — JANUARY. AVERAGE WIND VELOCITY (miles per hour) AT MIDNIGHT (oh), 97th MERIDIAN TIME.

II. — JANUARY. AVERAGE WIND VELOCITY (miles per hour) AT NOON (12 h.), 97th MERIDIAN TIME.



III. — JANUARY. SYNCHRONOUS INCREASE IN WIND VELOCITIES (miles and tenths per hour) FROM MIDNIGHT TO 6 H. OF 97th MERIDIAN TIME.



IV. — January. Synchronous Increase in Wind Velocities (miles and tenths per hour) from Midnight to 12 h. of 97th Meridian Time.

V. — January. Synchronous Increase in Wind Velocities (miles and tenths per hour) from Midnight to 18 h. of 97th Meridian Time.

VI. — July. Average Wind Velocity (miles per hour) at Midnight (oh), 97th Meridian Time.

VII. — JULY. AVERAGE WIND VELOCITY (miles per hour) AT NOON (12h.), 97th MERIDIAN TIME.

VIII. — JULY. SYNCHRONOUS INCREASE IN WIND VELOCITIES (miles and tenths per hour) FROM MIDNIGHT TO 6 H. OF 97th MERIDIAN TIME.

IX. — JULY. SYNCHRONOUS INCREASE IN WIND VELOCITIES (miles and tenths per hour) FROM MIDNIGHT TO 12 H. OF 97th MERIDIAN TIME.

X. — JULY. SYNCHRONOUS INCREASE IN WIND VELOCITIES (miles and tenths per hour) FROM MIDNIGHT TO 18 H. OF 97th MERIDIAN TIME.

amounting to .6 in the extreme north and the greater part of the centre, but in the extreme south and west reaching 2.0 or even 3.0 in special cases. It is to be noticed that for the high exposed anemometers at St. Louis and Atlanta there is a decrease, —.8, yet in the west at Winnemucca and Fort Assinniboine, there is an increase, .6, and in both cases this resembles the condition for the Atlantic and (north) Pacific Oceans respectively.

JULY. The charts for this midsummer month show much more clearly than those for January the effects of the diurnal heating up of the continent ; this was, of course, to be expected.

Chart VI., which gives the wind velocities at midnight for July, shows the following conditions as prevailing ; on the Atlantic coast for the exposed stations there is a wind of 10 miles per hour in the north which decreases to 8 at the centre ; and for a more land exposure this decrease is from 7 in the north to about 5 miles per hour in the south. On the Gulf there is an increase from about 7 in the east to 9 or 10 miles per hour in the west. For the Great Lakes the wind velocity is about 6 or 7 miles per hour. On the Pacific coast in the north (exposed station) the velocity is but 7, but this increases to 10.5 at the centre, with a decrease to 3 miles per hour at the south, with a gradually increasing land influence.

Inland, along about the 97th meridian, the velocity is 6 miles per hour. To the eastward of this it decreases to 4 along the lower Mississippi and lower Ohio rivers, and still further eastward, along the bases of the Appalachian Mountains, the velocity becomes but 3 miles per hour. For two small regions on the lower Arkansas River and on the Atlantic slope in Virginia, the velocity does not exceed 2 miles per hour. West of the 97th meridian the velocities on the Great Plains are about 7 at the north and south, and 8 miles per hour near the centre, with a culmination of 10 in Kansas. Along the eastern edge of the Rocky Mountains the velocity is about 7 miles per hour ; but west of this on the Great Plateau in the north it is 3, at the centre 5 or 6, and in the south 3 to 5 miles.

Chart VII. shows the wind velocities at noon (12h.), and is not further described.

Chart VIII. gives the changes from 0 to 6h., and shows on the Atlantic coast (exposed) an increase of .8, at the north, and a

slight decrease, —.3, at the centre, which probably becomes more marked at the south. For the Gulf a slight decrease, —.3, at the east, becomes greater, even, —4.2, at the west. For the Great Lakes there is an irregular increase ranging from .2 to about 1.0. On the Pacific slope a slight decrease, —.2 at the north becomes greater, —3.5, at the centre; but there is no change, .0, in the south.

Inland east of about the 95th meridian, there is an increase of wind, except near Keokuk and St. Louis, where there is a decrease, —.7, and also in the extreme southeast United States; and this increase varies from .0 to 1.0 without much regularity or law. West of the 95th meridian there is a decrease which is very irregularly distributed, but apparently least in the north and greatest toward the centre and south, ranging from about —.2 to —2.0, but in some cases reaching the extremes .0, and 3.0. It must be remarked that at the high exposure of Atlanta there is an increase of 1.0; while for St. Louis, Fort Assinniboine and Winnemucca, there is a decrease —.6.

Chart IX. gives the increase of wind from 0 to 12h., and, as was to be expected, there is scarcely a station showing a decrease, except on the central and northern Pacific coast. On the Atlantic coast extremely slight differences are noticeable, 2.0 to 2.5, and these vary but little from a common increase, 3.0, for the whole eastern coast with the poorer exposure. On the Gulf the increase is from 1.7 in the east to nearly 4.0 in the west, and on the Great Lakes from 2.2 in the east to 3.5 farther west. On the Pacific slope there is a decrease of —1.5, at the centre, but an enormous increase, 6.3, at the south, but the exposures must change considerably at the same time.

Inland, on the Great Plains there is considerable irregularity, ranging from 3.5 in the north, to 1.5 at the centre, 3.0 at the south centre, and 1.0 at the extreme south. To the eastward of this in the Mississippi Valley, at the north the increase is 3.5, at the centre 2.0, and at the extreme south 3.0. Still further east, in the central Ohio Valley the increase is over 4, but for most of the region west of the Appalachian Mountains it is about 3.5. East of these mountains, however, it is less, becoming but a little over 1.0 in some cases. To the west, at about the 107th meridian, the increase is only .2 in the south, and there is a decrease of —.3 in the north. Still further west on

the Great Plateau in the north, there are contradictory values ranging from a decrease of about 2.0 to an increase of about 3.0; near the centre the increase is about 1.2, while at the extreme south it varies from about 2.0 to 6.0. At the high exposures of St. Louis and Atlanta, the increase is relatively small and about the same as for neighboring low stations, and the same is probably true of Fort Assinniboine and Winnemucca.

Chart X. gives the increase from midnight to 18h. It is seen that on the Atlantic coast (exposed), the increase changes from .8 in the north to 1.3 at the centre; but for more of a land exposure the increase is .5 at the north and becomes numerically larger toward the south where it is 2.5. On the Gulf the increase is .0 in the east but becomes very large in the west where it reaches nearly 6.0 for an individual case. On the Great Lakes a decrease of —.3 for the lower lakes changes to an increase of 1.5 for the upper lakes. On the Pacific coast there is a general increase, amounting to 1.2 at the north, 7.5 at the centre, and 5.7 at the south.

Inland, on the Great Plains, there is an increase of 3.0 at the north, 1.5 at the centre, and 2.5 toward the south, where an individual case of no change occurs. To the east in the Mississippi River Valley at the north the increase is 3.0, but is only half as great at the centre and south. East of this region there is an increase of 2.5 at the north, but this becomes less with southward progress (the opposite to the variation near the coast) and is only 1.0 or 1.5 at the south. West of the Great Plains there is considerable irregularity, but an increase is present in all cases. For the eastern part of the Great Plateau an increase of 2.5 at the north becomes 1.5 at the south; but for the western part an increase of about 4.0 is common to both north and south, although isolated cases occur in the north (nearer the coast) with but 1.5, and in the south with an increase of nearly 8.0. The reversal, which is noticeable on other charts, is strongly marked here; and that is, a greater increase with southward progress at and near the coasts, and a reversion of this for the main inland region.

PRINCETON, NEW JERSEY, Feb. 19, 1895.

THE ORIGIN AND WORK OF THE DIVISION OF MARINE METEOROLOGY.*

LIEUT. W. H. BEEHLER, U. S. NAVY.

THE Division of Marine Meteorology in the Hydrographic Office of the U. S. Navy Department may be strictly said to have had its origin when Lieut. Maury became the Superintendent of the U. S. Naval Depot and Observatory in September, 1844.

Lieut. Maury's energies were almost entirely devoted to the hydrographic and meteorologic subjects, and he took immediate steps to collect information from the log-books of men-of-war and merchant vessels for the preparation of charts to show the prevailing winds and currents, their limits and general characteristics, the best sailing routes, the limits of fog, field ice, icebergs, and rain areas, all the physical features of the ocean, the feeding ground of whales, and all facts of interest or value to mariners.

These charts are known as Maury's "Wind and Current Charts." They include track charts, trade-wind charts, pilot charts, whale charts, thermal charts, and storm and rain charts.

As soon as merchant mariners understood the object and nature of this work they readily forwarded their log-books for examination, and have ever since promptly furnished all information in their power. Indeed the voluntary co-operation of the mariners of all nationalities in developing the science of marine meteorology deserves the highest praise and our most profound gratitude.

Lieut. Maury was superintendent for seventeen years, 1844 to 1861, during which he published the seven series of "Wind and Current Charts," together with eight volumes of "Sailing Directions," containing elaborate articles on ocean meteorology and nautical information.

The track charts, or "A" series, comprise the North Atlantic Track Charts in eight sheets; the South Atlantic Track Charts

* Reprinted from the Report of the Chicago Meteorological Congress, Part II., pp. 221–232.

in six sheets; the North Pacific Track Charts in eleven sheets; the South Pacific Track Charts in ten sheets; and the Indian Ocean Track Charts in eleven sheets. They show the frequented parts of the ocean, the general character of the weather and wind, and the force and direction at the different seasons of the year. They were compiled by Lieuts. Whiting, Humphreys, Porter, Wyman, Balch, Gibbon, Beaumont, Aulick, Welch, Temple, Wells, Fillebrown, Badger, and Woolsey, and Profs. Flye and Benedict, of the U. S. Navy.

The trade-wind charts, or "B" series, by Lieut. De Haven, consist of one sheet of the Atlantic; besides which there is one sheet, a Trade-wind and Monsoon Chart of the Indian Ocean, by Lieuts. Guthrie, Newcomb, Van Zandt, Stout, and Houston; these show the limits, extent, and general characteristics of the trade-wind regions, together with their neighboring zones of calms.

The pilot charts, or "C" series, comprise the North Atlantic in two sheets; the South Atlantic in two sheets; the Brazil in one sheet; the Cape Horn in two sheets; the North Pacific and South Pacific Pilot Charts. The Pilot Charts of the Indian Ocean are included in those of the Pacific.

The officers employed on these charts were Lieuts. Ball, Herndon, Dulany, Harrison, Forest, Wainwright, Guthrie, DeKoven, Deas, and Fitzgerald, and Passed Midshipmen Davenport, Powell, Balch, Roberts, DeKrafft, Woolsey, Jackson, Murdaugh, Semmes, Wells, Lewis, Brooke, Johnson, Terret, and Prof. Benedict. These charts show in every square of five degrees the direction of the wind for 16 points of the compass that will probably be found in that square during each month of the year, based upon the number of times the wind was reported to have been from that direction in former years; a time was a period of eight hours.

The thermal charts, or "D" series, include the North Atlantic Thermal Chart in eight sheets; the South Atlantic Thermal Chart in six sheets, the North Pacific Thermal Chart in eleven sheets; the Indian Thermal Chart in eleven sheets (not completed).

These charts were the work of Lieuts. Gant, Gardner, and Prof. Flye. These show the temperature of the surface of the ocean wherever and whenever it had been observed. The tem-

peratures are distinguished by colors and symbols, in such a manner that mere inspection of the chart shows the temperature for any month. The four seasons of the year are distinguished by the symbols. Isothermal lines for every 10° of surface temperature are drawn on these charts.

The storm and rain charts, or the "E" series, comprise those of the North and South Atlantic, each in one sheet. They were compiled by Lieuts. W. R. Taylor, Ball, Minor, Beaumont, Guthrie, and Young. They show in every square of five degrees the number of observations had for each month, the number of days in which there was rain, a calm, fog, lightning and thunder, or a storm, and the quarter from which it blew.

The whale charts, or the "F" series, are in four sheets for the whole world. They show where whales are most hunted, in what years and months they have been most frequently found, whether in shoals or stragglers, and whether sperm or right. These charts were compiled by Lieuts. Herndon and Fleming and Passed Midshipmen Welch and Jackson.

The physical map of the ocean was not completed.

Some idea of the work accomplished can be formed from the fact that 200,000 copies of the Wind and Current Charts, and 20,000 copies of the "Sailing Directions," were issued gratuitously to the masters of merchant vessels who had furnished information.

One of the most important historical events connected with Maury's meteorological work was the meeting of the first International Meteorological Congress.

The Maritime Conference held at Brussels for devising a uniform system of meteorological observations at sea met at the residence of the Belgian Minister of the Interior on the 23d of August, 1853, and adjourned on the 8th of September, 1853.

The governments participating were represented by the following officers, viz.: —

Belgium, by A. Quetelet, Directeur de l'Observatoire Royale, and Victor Lahure, Capitaine de Vaisseau, Directeur Général de la Marine.

Denmark, by P. Rothe, Capt.-Lieut., Royal Navy, Director Depot Marine Charts.

France, by A. Delamarche, Ingénieur Hydrographe de la Marine Impériale.

Great Britain, by F. W. Beechy, Captain, Royal Navy, F. R. S., and Henry James, Captain, Royal Engineers, F. R. S.

Netherlands, by M. H. Jansen, Lieutenant Royal Navy.

Norway, by Nils Ihlen, Lieutenant, Royal Navy.

Portugal, by J. de Mattos Correa, Capt.-Lieut., Royal Navy.

Russia, by Alexis Gorkovenko, Capt.-Lieut., Imperial Navy.

Sweden, by Carl Anton Pettersen, First Lieutenant, Royal Navy.

United States, by M. F. Maury, LL. D., U. S. Navy.

At the first session of the conference, Mr. Quetelet was made president, and Lieut. Maury was called upon to explain the object of his mission, which he did in the following words, viz.: —

GENTLEMEN: The proposal which induced the American Government to invite the present meeting originated with the English Government, and arose from the communication of a project prepared by Capt. Henry James, Royal Engineers, by order of Gen. Sir John Burgoyne, in which the United States Government was invited to co-operate.

Nineteen stations had been formed by the English authorities upon a uniform system and the direction of the observations confided to the immediate supervision of the officers in command of the respective stations. In the United States meteorological observations had been made since the year 1816.

The American Government sympathized with the proposal of the English Government, but said, "Include the sea, and make the plan universal, and we will go for it." I was then directed to place myself in communication with shipowners and commanders of the navy and mercantile marine, in furtherance of the plan.

With a view, however, of extending still further these nautical observations, the Government of the United States decided upon bringing the subject under the consideration of every maritime nation, with the hope of inducing all to adopt a uniform log-book.

In order to place the captains navigating under a foreign flag in a position to co-operate in this undertaking, Mr. Dobbin, Secretary of the Marine Department at Washington, has instructed me to make known that the mercantile marine of all friendly powers may, with respect to the Charts of the Wind and Currents, be placed on the same footing as those of the American Marine; that is to say, that every captain, without distinction of flag, who will engage to keep his log during the voyage upon a plan laid down, and afterwards communicate the same to the American Government, shall receive, gratis, the "Sailing Directions" and charts.

It has, consequently, been suggested to the captains that they should provide themselves with, *at least*, one good chronometer, one good sextant, two good compasses, one marine barometer, and three thermometers for air

and water. I make use of the expression, "at least," because the above is the smallest number of instruments with which a captain can fulfil the engagements he contracts upon receiving the charts. Foreign flags will thus enjoy the advantage of profiting at once by all the information collected up to this time. You will not fail to observe, gentlemen, that the observations made on board of merchant vessels with instruments frequently inexact are not to be relied upon in the same degree as those made where the instruments are more numerous and more delicate, and the observers more in the habit of observing. The former, however, from the fact of their being more numerous, give an average result, which may be consulted with advantage; but the observations made on board the ships of the navy, although fewer in number, are evidently superior in point of precision.

The object of our meeting then, gentlemen, is to agree upon a uniform mode of making nautical and meteorological observations on board vessels of war. I am already indebted to the kindness of one of the members present, Lieut. Jansen, of the Dutch Navy, for the extract of a log kept on board a Dutch ship of war, and which may be quoted as an example of what may be expected from skilful and carefully conducted observations. In order to regulate the distribution of the charts which the American Government offers gratuitously to captains, it would, in my opinion, be desirable that in each country a person should be appointed by the government to collect and classify the abstracts of logs of which I have spoken, through whom also the charts should be supplied to the parties desirous of obtaining them.

The conference met daily and continued its sessions until the 8th of September. The conference devoted itself to the consideration of the best form of a meteorological register for the use of vessels of war; every detail was carefully discussed, and two forms of "abstract logs" were adopted, one of which was an abbreviated form for the use of the merchant marine. These forms are practically the same as are in general use to this day. They consist of a series of columns in which are to be recorded the ship's position, the direction and rate of current, observed magnetic variation, direction and force of the winds, barometer with attached thermometer, dry and wet bulb thermometers, forms and direction of clouds, proportion of clear sky, hours of fog, rain, snow, hail, state of the sea, water temperatures at surface and at depths and its specific gravity, and the state of the weather, with an additional column for general remarks.

On a blank page were described the instruments and manner of using them, the corrections for barometer, index error, capacity, capillarity, and the height above sea level, when and by whom and with what standard it was compared, the correction to thermometers, and the scale of wind forces, derived from

speed sailing by the wind. The Beaufort scale was not then adopted.

The result of this conference was the establishment of meteorological observations throughout Europe and all over the world on a uniform system, on land as well as on the sea. Prussia, Spain, Sardinia, the free cities of Hamburg and Bremen, Chile, Austria, and Brazil joined the others in this co-operative work. It was decided to carry on these observations in peace and in war, and in case of capture the abstract log was to be held sacred.

At the close of the Congress Maury returned to Washington laden with honors. Many of the learned societies of Europe elected him an honorary member, orders of knighthood were offered him, and medals were struck in his honor. Humboldt declared he had founded a new science.

In 1855, Maury published his work, "Physical Geography of the Sea," which has been translated into German, French, Dutch, Spanish, Norwegian, and Italian. Maury instituted the system of deep-sea sounding, and was the first to suggest the establishment of telegraphic communication between continents by submarine cables. The first cable was laid on the line indicated by him.

On the 20th of April, 1861, the State of Virginia passed the ordinance of secession. Unfortunately, having been born in that State, near Fredericksburg, on Jan. 14, 1806, Maury felt that his native State demanded his first allegiance, and on that day he resigned his commission, turned all the property at the observatory over to Lieut. Whiting, and went to join the Confederates at Richmond. Maury left a number of his writings in an unfinished condition, some of which were subsequently published, and when he offered his services to the confederate government he had had no previous arrangement for any position of special honor; but on the contrary, by leaving the U. S. Navy, he made a great sacrifice of his personal ambition in order to do what he believed to be his duty to his native State, and with the loftiest patriotic motives. Only a short time before he resigned he wrote to his friends by all means to stay in the Union, and his resignation was such a surprise, in view of his Union sentiments, that he was accused of all sorts of treasonable and dishonorable conduct, such as the removal of buoys, etc. This was false.

When it became known in Europe that Maury had resigned, the Grand Duke Constantine offered him the post of superintendent of the observatory at St. Petersburg to continue his meteorological researches; the French Government also invited him to continue his meteorological work in France, and the Russian and French ministers carried these invitations by flag of truce through the lines. Maury declined these offers, saying that his country needed his services. He entered the Confederate Navy June 10, 1861, and in October, 1862, he established at Richmond the naval submarine battery service; but before this was far advanced he was sent to Europe to continue his experiments and to act as one of the confederate navy agents. He invented an ingenious method of torpedo defence with which he sailed to put in operation at Galveston, Texas. Upon his arrival at Habana he heard of Lee's surrender and offered to surrender himself.

In June, 1865, he went to Mexico, where he offered his services to the Emperor Maximilian, by whom he was appointed Director of the Imperial Observatory. Maury elaborated the immigration scheme in Mexico, and was appointed Imperial Commissioner of Immigration, with the idea of making Mexico a home for ex-confederates, and to develop the resources of that country.

In March, 1866, Maury arrived in England on a special mission, and during his absence Maximilian was overthrown and shot. Maury was received with great honor by scientists and former friends, and in view of his meteorological work they sought to repair his fortunes. He found employment by instructing European officers in the use of the torpedo, and he was offered a permanent position in France. But in 1868 the Act of General Amnesty having removed all objections to Maury's return, he accepted the appointment of professor of meteorology in the Virginia Military Institute at Lexington, where he was installed in September, 1868. During the last five years of his life he made a meteorological survey of the State of Virginia and by numerous lectures in different parts of the country he called attention to the importance of meteorological studies in behalf of agricultural interests. Maury died, as he had lived, a Christian, Feb. 1, 1873.

During his life he received the following honors: By the

Emperor of Russia, Knight of the Order of St. Ann; by the King of Denmark, Knight of the Dannebrog; by the King of Portugal, Knight of the Tower and Sword; by the King of Belgium, Knight of the Order of St. Leopold; by the Emperor of the French, Commander of the Legion of Honor; while Prussia, Austria, Sweden, Holland, Sardinia, Bremen, and France struck gold medals in his honor. The pope sent him a set of all the medals that had been struck during his pontificate as a mark of his appreciation of his labors for science. Maximilian decorated him with the Cross of Our Lady of Guadeloupe.

He became corresponding member of the *Naturkundige-Vereeniging in Nederlandsch Indie*, Batavia, Feb. 17, 1853; *Die Naturforschende Gesellschaft in Emden*, March, 1854; *Société des Sciences des Arts et des Lettres de Hainault*, 1854; *Academie Impériale des Sciences de Russe*, St. Petersburg, 1855; *Academie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique*, Brussels, 1854; New York Lyceum of Natural History, New York, 1865; Philadelphia Academy of Natural Sciences, 1858; *Die Gesellschaft zur Beförderung der gesammten Naturwissenschaften in Marburg*, 1856; Historical Society of New Jersey, 1856; Historical Society of Tennessee, 1857; *Die Gessellschaft für Erdkunde in Berlin*, 1858; *Gesellschaft der Wissenschaften*, Prague, 1858; *Director del Observatorio Nacional*, Mexico, 1865; *Consejero Honorario de Estado*, Mexico, 1865; *Miembro Honorario de la Sociedad Mexicana de Geografia y Estadistica*, Mexico, 1865; *Miembro de la Imperial Academia Mexicana de Sciencias*, Mexico, 1865; LL. D. of the University of Cambridge, England, 1867. He was also a member of several other learned bodies of which the records have been lost. With all these honors Maury's name will ever be held in the highest esteem by mariners of all nations, by the U. S. Navy, of which he was one of its most brilliant officers, and by the American people, who are proud of his achievements.

This Congress of Meteorology must also render to the name of Maury a tribute of most profound gratitude as the founder of the science of meteorology, and the highest honor for his great researches in every department of this science.

Commander J. M. Gillis became Superintendent of the Naval Observatory when Maury resigned, and on the 5th of July, 1862,

it was transferred from the Bureau of Ordnance to that of Navigation. Meteorological observations were continued, but the elaborate system of co-operating with the merchant marine was suspended until after the war.

Rear Admiral C. H. Davis became superintendent on April 28, 1865, and June 21, 1866, the U. S. Hydrographci Office was established, with the duty of making charts and publishing "Sailing Directions" and meteorological information. Very little progress was made with meteorological work during the next five years, beyond the occasional publication of pamphlets on the barometer, thermometer, hygrometer, and general meteorological information in "Sailing Directions."

The Hydrographic Office was reorganized on the 21st of January, 1871, under Capt. Wyman, and five separate departments were created, one of which was the meteorological department, the duties of which were defined to be: "To construct wind and current charts," according to adopted forms, and for this purpose to collect and systematically arrange the meteorological data on hand, or which may be received; to take charge of all log books, track charts, remark books, and such other books, charts, and papers as may be required in the construction of wind and current charts; to prepare and issue blank meteorological journals constructed according to the most recent requirements for the purpose of collecting meteorological data suitable for use in making special and general inquiries into the science; to keep informed on all subjects pertaining to meteorology and physical hydrography.

In 1873 it was decided to again commence the collection of information from men-of-war and merchantmen to accumulate matter for a new edition of Maury's charts, and requests for such data were sent out to the navy and merchant marine. The method was to collect data in squares of 5 degrees of latitude and 5 degrees of longitude for each month a vessel might be in one of the squares, and also for each fraction of a month.

Lieut. T. A. Lyons was in charge of the meteorological division, and, assisted by a number of other officers of the navy, he compiled the meteorological data collected, and in the course of three years the office published new sets of meteorological charts for the Atlantic and Pacific oceans, and the work was continued on similar charts for other oceans.

The North Atlantic Meteorological Charts are in 12 sheets, one for each month. They extend from the equator to N. 60° and E. 10° to W. 85°, with a subchart on the same sheet for the western part of the Gulf of Mexico. In each square are expressed the percentage of the total number of hours of observations of the true compass directions and force of wind, the calms, variables, rain, fogs, moderate and heavy squalls, gales (all winds above the force of 8, Beaufort scale), the mean barometer, thermometer (both wet and dry bulbs), surface temperature, and the daily ranges of these instruments.

Blank meteorological journals were issued to masters of all merchant vessels who agreed to keep them and co-operate with the office, in October, 1877. These journals are still being kept by masters of merchant vessels, but in 1887 they were superseded by the forms for Greenwich noon observations. The journals are similar to the abstract log books adopted by the Brussels Conference. There are 4,000 of these journals in this office containing data of great value, which are kept available for the preparation of synoptic charts of all oceans. These will enable the office to publish pilot charts of other oceans similar to those of the North Atlantic.

From 1873 to 1883 the work of the Division of Marine Meteorology was conducted on the lines described for the preparation of the new "Wind and Current Charts" on Maury's plans, revised by Lieut. T. A. Lyons. Capt. S. R. Franklin became the hydrographer on May 17, 1878, and he was relieved by Capt. J. C. de Krafft on July 15, 1880; the latter was assisted by Lieut. Commander C. D. Sigsbee. Commander J. R. Bartlett was appointed hydrographer June 30, 1883.

To bring the office in close touch with the merchant marine, branch hydrographic offices were established in 1883 at New York, Philadelphia, and Boston, and were each placed in charge of a naval officer. Mariners were invited to visit these offices to obtain nautical information, to compare their meteorological instruments, and secure the latest hydrographic publications. These offices issued the log books, blank forms, etc., and were so successful in securing the co-operation of mariners with the office that other branch offices have since been established in all the principal ports of the country, viz., Baltimore, Norfolk, Savannah, New Orleans, San Francisco, Portland, Port Townsend, and Chicago.

Lieut. S. M. Ackley was in charge of the Division of Marine Meteorology from June, 1883, until June, 1887. In December, 1883, the office commenced the publication of the monthly Pilot Charts for the North Atlantic Ocean. The great practical utility of these charts was demonstrated from the very first, and the work of the division has chiefly been devoted to the publication of these charts. Improvements are constantly being made, and the early issues bear no comparison with those of the present time.

The Pilot Charts are the result of the co-operative work of mariners of all nations, and the number of those who co-operate is constantly increasing. In 1884 there were only 127 observers of the merchant marine, while on June 30, 1893, there were 2,844, besides the observers in the navy.

Lieut. G. L. Dyer relieved Commander Bartlett as hydrographer June 1, 1888, and was succeeded by Capt. H. F. Picking in June, 1889. He was relieved by Lieut.-Commander R. Clover, September, 1890, and the present hydrographer, Commander C. D. Sigsbee, took charge June 1, 1893. Ensign Everett Hayden, marine meteorologist, was in charge of the division from June, 1887, until May 19, 1889, when Lieut. H. M. Witzel relieved him until Jan. 21, 1892, when Lieut.-Commander E. W. Sturdy took charge until Dec. 15, 1892, when he was succeeded by Lieut. W. H. Beehler, at present in charge of the Division of Marine Meteorology. The force in the office consists of four nautical experts (graduates of the U. S. Naval Academy in civil life), viz., Messrs. T. S. O'Leary, R. L. Lerch, L. H. Orr, and H. H. Balthis, a stenographer, and a messenger. This force is engaged on the final work of preparing the data and investigating the various problems for the practical presentation of meteorological information to mariners.

The work is conducted under the Hydrographic Office, and all the divisions in that office are concerned in the work. In fact, the pilot charts were originally intended merely as a means for inducing the co-operation of mariners in hydrographic work. These charts are presented to observers in exchange for their reports, and the chart has proven to be such a desirable method of communicating hydrographic and meteorological information to mariners that it has become of the greatest value. The work is, therefore, not so much a scientific study as a practical pre-

sentation of facts for the use of practical men. Advantage is duly taken of every new discovery when clearly established, but the investigations are for their practical value and for immediate use.

Under the direction of the hydrographer, the Division of Chart Construction prints the charts, the Division of Sailing Directions supplies the hydrographic information for the pilot charts, and the Division of Charts gives notice of the charts published, cancelled, and extensively corrected. The branch hydrographic offices issue the forms and publications to mariners, receive and forward their reports, compare and correct their instruments, and by personal visits to vessels in port secure the co-operation of additional observers. The office also has the co-operation of the United States Weather Bureau, and by the system of exchanges also has access to the reports obtained by the New York Herald Weather Service. The keepers of the lighthouses and light vessels of the United States Lighthouse Establishment also co-operate, while there are a number of voluntary observers among the keepers of lighthouses on the coasts of Newfoundland and Labrador, who send valuable and timely reports of the ice movement on those coasts. Voluntary observers in the West Indies and other islands send valuable reports. A number of foreign meteorological observatories and societies correspond with the office, and the United States Consular Service renders valuable aid by forwarding reports and bringing the work to the attention of mariners, by which many additional co-operators are secured. The method of current investigation with bottle papers has brought a great many to assist in the work. On the coast of Ireland bottle papers are frequently found, and many very amusing letters are received. In one the finder requested that if the paper was of any value he thought that the office should send him the price of a pair of boots, as he had lost the only pair he had while standing in the tide examining the document.

From this extensive field the office has naturally collected a vast amount of data, so that it is pre-eminently well equipped to continue the work and extend the system of the North Atlantic Pilot Charts to all oceans, and steps to that end have been taken.

The following is a list of reports received: Trade winds, ice,

wrecks, fogs, buoys adrift, whales, meteorological journals, storms, Greenwich noon observations, the use of oil to still the waves, waterspouts, ocean currents, Gulf Stream, abstract logs, derelicts, barometer comparisons, curves of self-recording barometers and thermometers, track charts of vessels' voyages, routes of transoceanic steamers, sailing routes, reports of deep-sea soundings, auroras, thunderstorms, electrical phenomena, and general information.

Blank forms are issued for these reports which are forwarded to the hydrographer, and if not acknowledged by the branch office are answered by him.

In 1883 a weekly supplement, since known as the "Hydrographic Bulletin," was issued and has been regularly published ever since, for the special use of the United States coastwise navigators. It has notices about obstructions, dangers, ice, and fog, but does not go into much detail for meteorological information. Two thousand copies are printed every Wednesday.

Upon the receipts of the reports the data are immediately plotted on synoptic charts from which the pilot charts are prepared. Reports in foreign languages are translated and utilized. The daily synoptic charts are being prepared for publication.

The pilot charts are printed in three colors. The black is a transfer on stone from a regular engraved copper plate of the Mercator's chart of the ocean. The blue data consist of the meteorological forecasts and routes; they are compiled from the accumulated data on the synoptic charts of previous years and indicate the probabilities based upon experience in this month in previous years.

The red text is furnished the day before the chart is published and consists of a review of the weather for the previous month up to the date of publication, the storm tracks, fog limits, drifting ice and icebergs, the position of derelicts, wreckage, etc., and, in the space over the land in the left-hand corner, gives general information of timely interest concerning special reports, storms, currents, use of oil, dangers in the navigation, etc.

Supplements are frequently issued relating to storms, remarkable drifts of derelicts, wreck charts, ocean currents, routes, and the use of oil. Four thousand copies of the pilot charts are distributed monthly.

The pilot charts have, perhaps, more than any other agency, brought about the general recognition of the value of the use of oil to still the waves, and the masters of hundreds of vessels have reported that they were saved from total loss, with all on board, by the use of oil on seas.

The charts have served to bring about the adoption of regular ocean lanes for transatlantic steamers to minimize the risk of collision.

During the past six months the accumulated meteorological data have been arranged and systematically classified, and a card catalogue has been inaugurated by which all marine meteorological information in all the department libraries is made immediately available. The system adopted is a classification of all the work in three departments: Meteorology, Oceanography, and Shipping, each of which is divided into a number of subdivisions, and each subdivision again divided into a number of branches, so that every subject is carded in its proper branch of its division of its department.

A new base plate is being engraved for an improved pilot chart which will be designated as a co-operative chart for mariners, in order to emphasize the fact that it is a practical presentation of the meteorological facts reported by co-operating observers.

It is contemplated to largely increase the working force of this division, and it is hoped that the members of this Congress will approve this work and co-operate with the division by giving it the practical results of their scientific investigations for the use of practical men.

The Congress is requested to consider the advisability of taking at least one observation each day at the time of Greenwich noon. The 2,844 co-operating observers of this office on vessels cruising in all parts of the world take the observations at this time, and if such observations are taken on land as well as at sea, the meteorological conditions all over the world can be seen from daily synoptic charts.

Observations may be taken, in addition, at other times, as at present; and in the Pacific, observations at Greenwich midnight are recommended, but there is urgent need for one observation daily at Greenwich noon by each observer.

In preparing this paper I have consulted: "Founding and

Development of the U. S. Hydrographic Office," by Lieut. W. S. Hughes, U. S. Navy; "Memoir of the Founding of the U. S. Naval Observatory," by Prof. J. E. Nourse, U. S. Navy; "Life of Matthew Fontaine Maury," by his daughter; Maury's "Sailing Directions"; "Appleton's Cyclopedia of American Biography"; "Annual Reports of the Hydrographer," and official records in the Division of Marine Meteorology.

CURRENT NOTES.

Royal Meteorological Society. — The monthly meeting of this Society was held on Wednesday evening, May 15, at the Surveyors' Institution, Westminster, Mr. R. Inwards, F. R. A. S., President, in the chair.

Mr. G. J. Symons, F. R. S., and Mr. G. Chatterton, M. Inst. C. E., read a paper on "The November Floods of 1894 in the Thames Valley," which they had prepared at the request of the Council of the Royal Meteorological Society. This consisted of a systematic description of the causes which led to the great floods of November last, and an analysis of the records obtained from the Thames Conservancy Board, from the engineers of several of the towns along the river, and also from rainfall observers throughout the Thames watershed. The information was given chiefly in the form of tables, one of the first being a chronological history of floods in the Thames Valley from the year 9 A. D., down to the present time. This was followed by a short description of the damage wrought in November, 1894, which was illustrated by a number of interesting lantern slides. Details were then given of the levels reached at various places in all the principal floods from 1750 to the present time. The authors exhibited a map showing the relative elevation of all the parts of the Thames basin, and then gave details of the rainfall for each day from Oct. 23 to Nov. 18, 1894. The results obtained by the Thames Conservancy Board, showing the flood levels at each lock, were exhibited on a longitudinal section from Lechlade to Teddington, and the hydraulic inclinations from lock to lock were shown in a tabular form. The volume of flood water, as gauged by the Thames Conservancy at Teddington, rose rapidly from 4,000 million gallons per diem on Nov. 12 to 10,250 million gallons on the 16th, 12,800 million gallons on the 17th, and to over 20,000 million gallons on the 18th, when the discharge reached its maximum. The last-named discharge is equivalent to 0.37 inch over the whole watershed of the Thames above Teddington Lock.

Mr. F. J. Brodie also read a short paper "On the Barometrical Changes preceding and accompanying the heavy Rainfall of November, 1894," from which it appeared that the latter half of October was characterized by unusually bad weather, especially in the more western and southern parts of the British Isles. The torrential rains of Nov. 11 to 14, which actually caused the floods, were due to two secondary depressions which developed a certain amount of intensity as they passed over the southern part of England.

The last meeting of this Society for the present session was held on Wednesday evening, June 19, at the Surveyors' Institution, Westminster, Mr. R. Inwards, F. R. A. S., President, in the chair.

Mr. R. H. Curtis, F. R. Met. Soc., read a paper on the "Hourly Varia-

tion of Sunshine at Seven Stations in the British Isles," which was based upon the records for the ten years, 1881–90. Falmouth is decidedly the most sunny station of the seven, having a daily average amount of sunshine of 4½ hours. This amount is half an hour more than that recorded at Valencia, and three quarters of an hour more than at Kew. Of the other four stations, Aberdeen, the most northern but at the same time a coast station, with 3.64 hours, has more than either Stonyhurst or Armagh, both inland stations; whilst Glasgow, with only three hours, or about a quarter of its possible amount, has the smallest record of the seven, a result to some extent due to the nearness of the observatory to the large manufacturing works with which the city of Glasgow abounds. At Valencia, Kew, Stonyhurst, and Armagh, the maximum duration is reached in May, the daily mean amount varying in the order named from 6¾ to 6 hours. At Falmouth and at the Scotch stations the increase goes on to June, when the mean duration at Falmouth reaches 7½ hours; at Aberdeen 6¼ hours, and at Glasgow 5.6 hours. January and December are the most sunless months of the year. The most prominent feature brought out at all the stations is the rapid increase in the mean hourly amount of sunshine recorded during the first few hours following sunrise, and the even more rapid falling off again just before sunset.

Mr. H. Harries, F. R. Met. Soc., read a paper on the "Frequency, Size, and Distribution of Hail at Sea." The author has examined a large number of ships' logs in the Meteorological Office, and finds that hail has been observed in all latitudes as far as ships go north and south of the equator, and that seamen meet with it over wide belts on the polar side of the 35th parallel.

Meteorology in the Schools. — Mention has already been made in this Journal (for June, 1894, pp. 76, 77) of the plan proposed by the New England Meteorological Society for giving instruction to teachers in the practical use of the daily weather maps in schools. The plan, proposed by Prof. W. M. Davis, was adopted at the meeting of the Society held in Boston, April 21, 1894, and Profs. Davis of Harvard University, Winslow Upton of Brown University, and Mr. R. DeC. Ward, editor of this Journal, were appointed by the president of the Society a committee to have charge of the work. As a result of the first winter's work lectures were given to teachers in Cambridge and Hingham, Mass. The following paragraphs in connection with this matter are taken from the Annual Report of the School Committee of the City of Cambridge for 1894, prepared by the Superintendent of Schools (pp. 49, 50): —

"During the winter, a series of ten meetings has been held at the Harvard University Museum in Cambridge, where Prof. William Morris Davis, assisted by Mr. R. DeC. Ward, met a number of teachers from the Grammar schools for the purpose of giving practical instruction in the use of the daily weather maps in the schools, as a means of laying a foundation for a proper understanding of climatology, as it is afterwards encountered in geographical study. These meetings grew out of the action of the New England Meteorological Society in appointing a com-

mittee, consisting of Prof. William Morris Davis of Harvard University, Prof. Winslow Upton of Brown University, and Mr. R. DeC. Ward, assistant in meteorology at Harvard and editor of the AMERICAN METEOROLOGICAL JOURNAL, 'to consider and report upon action that might be taken by or through the Society regarding practical instruction to teachers on the use of the weather maps in schools.' The plan proposed by the committee was outlined by Prof. Davis to the masters of the Cambridge Grammar schools last November, and by them communicated to a limited number of their teachers, who were selected to attend the proposed meetings. The meetings began in November and extended into January. The plan of instruction was based on the outline of the subject given in the Report of the Committee of Ten on Secondary Education, and included brief instruction regarding local weather observation, practical exercises on the preparation and interpretation of weather maps, with some explanation of the relation cf the facts that they exhibit to general meteorology. Particular emphasis was given to the importance of advancing slowly, in order that the scholars should really acquire an understanding of the work as it progressed.

"As a result of this course, something of elementary observation of the weather has been begun in several of the schools; outdoor thermometers have been provided, the previous equipment of the schools having been limited to indoor thermometers, which were observed only for hygienic purposes. A number of weather maps were distributed, and outline maps for practice were provided as needed.

"Much interest has been shown in the work, and several of the teachers have introduced some systematic instruction in meteorology in their schools.

"These lectures have been repeated in Hingham, Mass., and they have proved to be of great help to teachers working along the lines in geography proposed in the report of the Committee of Ten. It is proposed by the committee to offer similar courses during the winter of 1895-96 to teachers in other places. Prof. Davis or Mr. Ward will give more definite information in regard to these lectures."

Blue Hill Weekly Weather Bulletin. — In the September, 1894, number of this JOURNAL, page 197, mention was made of a weekly weather bulletin issued by Mr. H. H. Clayton of Blue Hill Observatory, Readville, Mass. This "Bulletin," which was first published on June 1, 1894, has been successfully continued through the winter. Some interesting facts as to the verification of Mr. Clayton's forecasts, given in the issue of the "Bulletin" for the week of July 20-27, 1895, are here reprinted: —

"At the request of the editor of the Bulletin last November, a committee consisting of Dr. S. C. Chandler, Mr. John Ritchie, Jr., and Mr. Paul S. Yendell, was appointed by the Boston Scientific Society to verify the weather forecasts made in the 'Bulletin' and report in regard to their accuracy. These men have national reputations as scientists and trained investigators, and every precaution was taken at the beginning to prevent any error or bias in the verification by obtaining strict definitions of the words and phrases used in the forecasts, and by comparing them with the official records of the weather made at the Boston office of the United States

Weather Bureau. The verification was carried on for three months with the following results: —

	Percentage of the time rain fell.			
	Nov.	Dec.	Jan.	Mean.
When rain was forecasted . .	26	29	28	28
When clear was forecasted . .	10	0	27	12
Excess in favor of forecast . .	16	29	1	16

"The mean temperature verification for the three months was 51 per cent. It was hoped to continue the verification for a longer interval, but it was not found practicable. The verifications were, however, carried forward in the same manner and with equal care at the Blue Hill Observatory, and the following are the mean results obtained for the eight months from November to June: Percentage of the time rain fell when rain was forecasted, 27, and when clear weather was forecasted, 17, making the frequency of rain 10 per cent greater when rain was forecasted. When clear weather was forecasted, the weather was found clear or partly cloudy without a trace of rain about 70 per cent of the time; and in only one month out of eight was the frequency of rain greater when clear weather was forecasted than when rain was forecasted. The verification of temperature indicates that the forecasts were about 66 per cent verified during the summer and early autumn of 1894, but fell to about 50 per cent during the winter and spring.

"The success of the forecasts has not been as great as was hoped, but it will be seen from the percentages quoted that in the average the excess has been in favor of the forecasts and prove that they have a real basis in fact. Whether the accuracy is yet sufficiently high to have a practical or commercial value can only be decided for himself by each subscriber. The methods of forecasting are under continuous investigation at the Blue Hill Observatory which is supported by Mr. A. Lawrence Rotch for scientific research. The effort to make the results of practical value is an experiment undertaken by the editor. If those who have shown an interest in the 'Bulletin' continue their support they will aid materially in the final solution of this problem, and, with the greater experience and greater knowledge which will come with time, there seems every reason to believe that the forecasts will steadily gain in accuracy until they become indispensable."

Valley Winds at Ithaca and Utica, N. Y. — In the report on the "Climate of the State of New York," by Mr. E. T. Turner, in the "Fifth Annual Report of the New York State Meteorological Bureau" (Albany, 1894), there are some notes on the occurrence of valley winds at Ithaca and Utica. Ithaca is situated at the southern end of Cayuga Lake, the trend of the valley and of the lake being about north and south. The night, or valley wind, "usually commences from one to two hours after sunset, blowing from the south down the channels of the two principal streams flowing into Cayuga Lake. At first a light breeze, it increases in force during the night, and attains a maximum velocity probably not less than eight miles per hour. The current in the main valley at the head of the lake (as observed by means of small balloons) is from 50 to 100 feet in depth before midnight, and no doubt becomes greater before morning. This volume of cold air

gradually increases until sufficient to overcome the heating effect of the lake waters, reaching the northern extremity of the valley toward morning."

At Utica the valley opens both eastward and westward from the city, the highlands rising mainly towards the northeast and southeast of the city. "The following observations upon the winds during the winters and summers of two years were found in the report of the Board of Regents (second series): —

DIRECTION OF SEASONAL WINDS.

	Hours and Number of Observations. 6 A. M.	2 P. M.	10 P.M.
In summer:			
Number of observations of easterly winds . .	116	44	47
Number of observations of westerly winds . .	93	160	59
In winter:			
Number of observations of easterly winds . .	97	93	77
Number of observations of westerly winds . .	81	127	108

"The prevailing winds at midday, while mainly due to the general atmospheric circulation, must be considerably strengthened by the updraught of air on the heated hill slopes. At night, when the motion of the upper currents is no longer imparted to the surface air by convectional action, the downflow from the hills proceeds unchecked; but owing to the distance of the city from the highlands, the easterly wind does not become fully established there until after the evening observation, and is much more apparent in the early morning. The large percentage of cloudiness in winter evidently tends to decrease the frequency of easterly winds at that season."

A Portable River Bulletin. — From the Cairo, Ill., *Daily Argus*, of April 13, 1895, we learn some of the details regarding a new portable river bulletin, designed by Mr. W. T. Blythe, Local Forecast Official in charge of the Weather Bureau Station at Cairo. The bulletin consists of a frame about ten feet long, which is to be placed longitudinally on the upper deck, or texas, of the river steamers, and in which are to be placed figures and letters, 2 x 2½ feet in size, painted on movable plates of sheet iron. The letters and figures are so arranged that only thirty separate pieces of sheet iron are used in indicating any stage from 9¾ feet below zero to 76¾ feet above. The letters "R," "F," and "S" indicate whether the river was rising, falling, or stationary at the time of the vessel's departure. Gauge readings are to be taken at Cincinnati, Louisville, Cairo, Memphis, Vicksburg, and New Orleans.

This bulletin board, says the *Argus*, is the only one of the kind on the western rivers, and will prove of great value to people living on low lands, especially during extreme high water, as well as to pilots during low water.

Meteorological Observatory of St. Louis at St. Hélier, Jersey (Channel Islands), Lat. 49°, 12′ 4″ N., Long. 2° 4′ W. of G. — During the year 1894 a meteorological observatory was erected upon the Island of Jersey, off the north coast of France, under the direction of the Jesuits. The observatory is built upon the southwest edge of the plateau which forms the island, and

is about 55 meters above the level of the sea. A tower 50 meters high has been erected for the study of winds and atmospheric electricity. The anemometer will be placed at an elevation of 110 meters above sea level. The director is Rev. Marc Dechevrens, who has done such excellent work as director of the Zi-ka-wei Observatory, near Shanghai, China, from 1876 to 1886.

The first results of observations are contained in the *Bulletin des observations météorologiques, 1ère année*, 1894, 4°, Jersey, 1895, 30 pp. The Bulletin contains monthly means of the usual elements derived from four daily readings or from self-recording instruments. Monthly means for each hour of the day are given for the entire year for pressure and temperature.

The observatory promises to take rank among the first order observatories devoted to meteorology and magnetism.

Meteorological Observations at Edinburgh in 1894. — Mr. R. C. Mossman has sent to this JOURNAL his report on the meteorological observations at Edinburgh during 1894. The most important data are as follows: Highest barometer reading, 30.759 in., Jan. 3 at 9 P. M.; lowest barometer reading, 28.121 in., on Dec. 22 at 6 A. M. Highest shade temperature, 77.5°, on July 6 at 1 P. M.; lowest shade temperature, 13.9° on Jan. 6 at 8.30 A. M. Greatest range of temperature, 31.4° on March 29; least range of temperature, 2.7° on July 25. Greatest daily rainfall, 1.47 in. on Feb. 16.

Belgian Astronomical Society. — The *Société Belge d'Astronomie* has issued a publication containing the constitution and by-laws of the Society, together with a circular letter regarding the objects of the organization and its work. Meteorology, Geodesy, and Terrestrial Physics are included within the scope of the Society's field of labor. Among the officers are M. J. Vincent, meteorologist at the Royal Observatory, Brussels, and M. Ch. Lagrange, astronomer at the same institution, the latter of whom is an editor of *Ciel et Terre.*

Meteorology at the University of Chicago. — Dr. L. A. Bauer has been giving a series of popular weekly lectures at the University of Chicago during the summer. The dates and subjects of the lectures were as follows: July 3, "The Evolution and Functions of the Atmosphere"; July 10, "The Physical Properties of the Air"; July 24, "The Winds, their Causes and Characteristics."

During the Fall Quarter (Oct. 1–Jan. 1), Dr. Bauer is to give a course in General Meteorology (4 hours per week), and during the Spring Quarter (Jan. 1–April 1), a course in Theoretical Meteorology.

Jamaica Rainfall for 1893. — The mean rainfall for the island of Jamaica in 1893, as reported by Mr. Robert Johnstone, of the Weather Office at Kingston, in "Jamaica Rainfall for the Year 1893," was 86.49 in., an excess of 19.5 in. over the mean for the twenty years 1870–1889. The greatest rainfall for the year was 177.34 in., and the smallest, 34.29 in. The greatest monthly fall was 43.60 in.

BIBLIOGRAPHICAL NOTES.

FRYE'S COMPLETE GEOGRAPHY.

ALEX. EVERETT FRYE. *Complete Geography*. Large 8vo. Ginn & Company, Boston, U. S. A., and London, 1895. Pp. 184. Appendix of 24 pages of Reference Maps. Price for Introduction, $1.25.

When we read in the preface of Mr. Frye's "Complete Geography," that "William Morris Davis, Professor of Physical Geography in Harvard University, has given very valuable assistance in the preparation of this work," and that "the treatment of the atmosphere and the elementary land forms is based on manuscripts of Prof. Davis," we may feel perfectly sure that the subject of meteorology has received worthy consideration at his hands, and that it has been presented in an attractive, rational, and scientific way. We wish that we could take the space to review, with the care that it deserves, the whole of this new geography. It is the first one which presents the modern aspect of the new physical geography, with the development and teaching of which Prof. Davis has had so much to do. In the place of the old methods of treatment which were so largely statistical, unmeaning, and disjointed, we now have a living, rational human view of the subject, in which we see that land forms go through a life history as well as plants and animals, and that the stage in which we find a mountain, or shore line, or river to-day, is only one stage in the long process of development and degradation through which these forms must all pass. When viewed in this light, the whole aspect of the earth's surface changes, and instead of the old dead, fixed condition in which we used to believe that all land forms were, we now see them all alive, and undergoing the changes of youth, maturity, and old age, to which animals and plants are subject. It is this treatment of physical geography which we have in Mr. Frye's book, and which is to be the treatment, we confidently believe, that this subject will receive everywhere in the near future.

It is, however, with meteorology that we are here chiefly concerned, and we may say at once, that we know of no school geography which gives so simple and yet so scientific a treatment of the subject as does this new book of Mr. Frye's. The paragraphs on "Rainfall," "Work of the Winds," and "Snow and Ice," are brief, but full of information, and much of it of a kind not usually found in geographies. The most original, and to our mind the most valuable, matter presented in connection with meteorology in the book is that concerning the "Belts of Heat" and "Seasons of the Heat Belts," on pages 18–21. We believe that this division of the earth's surface into "heat belts" is original with Prof. Davis, and it certainly deserves high commendation. The plan of division is briefly this: —

Near the equator where the sun's rays are vertical or nearly so, the air is hot all the year, except high above sea level, and this is called the *hot*

belt. Around the poles the rays always slant a great deal, and the air is always cold or cool. Here, then, we have the *cold belts.* Between the *hot* and *cold* belts there are two *warm* belts, where the sun's rays fall with but little slant, north and south of the *hot* belt; and between the *warm* and *cold* belts, on each side of the equator lies a *cool* belt, where the rays are very slanting. The regions occupied by these several belts are shown on two different charts, one representing views of the two hemispheres with the limiting lines of the belts drawn, and the other showing these lines on a Mercator's projection chart. The *hot belt* occupies the region over which the heat equator migrates, the northern boundary being the line of the heat equator in July, and the southern boundary being the line of the heat equator in January. The *hot belt* is naturally wider on the lands than over the oceans. The slant of the sunshine varying little throughout the year, the changes of season in this *hot belt* are slight, and there is no winter. North and south of the hot belt came the *warm belts*, wider on the oceans than on the lands, and with cool winters and hot summers on the lands. The *cool belts*, north and south of the *warm belts*, differ considerably in the two hemispheres. In the northern the lands are wide in this belt, and the winters are very cold, especially in the north, while the summers are very warm, especially in the southern portions. In the southern cool belt there is but little land, and the seasons vary over it from warm to cool only. The *cold belts* have long and extremely cold winters, and cool summers. Some very concise and easily remembered statements are given on page 21. "During our summer, hot weather spreads into the northern warm belt; the warm weather shifts into the cool belt; the cool weather shifts into the cold belt; the cold weather dwindles away and perhaps disappears from the north polar region. During our winter the cold weather of the northern cold belt spreads far southward over the cool belt; the cool weather shifts to the warm belt; and warm weather only is felt at the border of the hot belt. South of the equator, the opposite changes are meanwhile taking place. When the warmer weather swings northward from the equator, the cooler weather shifts towards that line from regions south of it; but, owing to the smallness of the southern lands, and the vastness of the oceans, the seasons south of the equator do not present great extremes of heat or cold."

The rigid conception of torrid, temperate, and frigid zones, with which everyone becomes familiar in school, is not the proper conception of the climatic divisions, and it is with the greatest satisfaction that we find in this geography for school use a clear and simple statement concerning this important subject, viewed in its more rational aspect. The figures admirably set forth the unsymmetrical forms of the different belts, and the effect of ocean currents and winds in determining these shapes is explained in the text. We wish all grown persons, as well as the children who will use this geography, would get this view of the zones.

The difficult subject of the winds is made as simple as possible, and yet is sufficiently explicit for the use of the scholars, and it is a solid satisfaction to see a scientific treatment of the general surface circulation of the atmosphere in a school geography. In the figure on page 23 ("General Plan of the Winds,") the occurrence of eddying storms is noted as characteris-

tic of the prevailing westerlies and entered on the chart, so that the scholar is at once brought face to face with one great feature of the climatic and weather peculiarities of the latitudes blown over by these winds. The striking connection between the general system of winds and rainfall is well shown in two charts on page 24.

Throughout the book, in describing the climates of the different countries, the winds, rainfall, etc., are not taken as apart by themselves, but are continually associated with the great facts as to the heat belts, the general circulation of winds, and the general rainfall of the world, previously considered. In the sections on climate, near the end of the book, some admirable colored charts of temperature ranges, January and July temperatures, and rainfall are given, together with descriptive text.

We have given considerable space to our notice of Frye's Geography because we consider the book an excellent one in every way. We have noted particularly the treatment of meteorology in it, and we do not hesitate to say that meteorology has never been more scientifically treated in any school geography. The older geographies are full of disjointed statements, often incorrect, as to winds, rainfall, and climate. In this book we have a treatment by one who is thoroughly familiar with his subject, has taught it for years, is the author of a text-book on it, and has been active in the work of introducing the study of meteorology into the schools. It may seem to some that we have said too much in praise of this book, but if those who think so will compare the treatment of meteorology that is found in the average school geography with that which Frye's new geography presents, they will probably agree with us. We commend the book as a whole most heartily to grown persons.

REPORT OF THE INTERNATIONAL METEOROLOGICAL CONGRESS AT CHICAGO.

Report of the International Meteorological Congress held at Chicago, Ill., Aug. 21–24, 1893, *under the auspices of the Congress Auxiliary of the World's Columbian Exposition.* Part II. Edited by Oliver L. Fassig, Secretary. United States Department of Agriculture, Weather Bureau. Bulletin No. 11. Part II. 8vo. Washington, D. C., 1895. Pages xv–xvi, 207–583. Pls. XX–XXV.

The first part of the Report of the Chicago Meteorological Congress was issued in the spring of 1894, and was reviewed in the June, 1894, number of this JOURNAL, a full list of the papers contained in that part being printed at that time; the second part has been unavoidably delayed, owing to various circumstances over which Mr. Fassig, the editor, had no control, and has but recently appeared, after reprints of a good many of the papers it contains have been distributed by their authors.

The present part includes the papers presented to Sects. IV., V., and VI., on "History and Bibliography," "Agricultural Meteorology," and "Atmospheric Eiectricity and Terrestrial Magnetism." We repeat what we said in reviewing the first part of the Report, that at the present time, when such rapid progress is being made in the various branches of meteorology, it is a great satisfaction for the student to be able to refer to articles written by authorities on the different subjects, which give a résumé of what is known in each case. The Chicago Congress was the means of collecting a very valuable series of papers on meteorological matters, and this Bulletin should be kept at hand for reference by any one who wishes to be informed of the present state of our knowledge on the various subjects treated at the Congress. We regret to note that two important manuscripts prepared by Dr. Neumayer, of the German Naval Observatory at Hamburg, were lost in transmission by mail, and no copies had been retained of them. The subjects of these articles were as follows: "International Co-operation in Prosecuting Work and Publishing Results in Ocean Meteorology," and "On the Cartographic Presentation of the Distribution of the Forces of Terrestrial Magnetism and their Variations."

We give below a full table of contents of the second part of the Report of the Congress.

Section IV. — History and bibliography.

1. The connection of the Army Medical Department with the development of meteorology in the United States. Maj. Charles Smart, U. S. Army.
2. The meteorological work of the Smithsonian Institution. Prof. S. P. Langley, Secretary.

3. The origin and work of the Division of Marine Meteorology of the Hydrographic Office, U. S. Navy. Lieut. W. H. Beehler, U. S. Navy.
4. The meteorological work of the U. S. Signal Service, 1870 to 1891. Prof. Cleveland Abbe.
5. State Weather Service organizations. Maj. H. H. C. Dunwoody, U. S. Army.
6. Early individual observers in the United States. Alfred J. Henry, U. S. Weather Bureau.
7. Simultaneous meteorological observations in the United States during the eighteenth century. Alexander McAdie, U. S. Weather Bureau.
8. The Redfield and Espy period, 1830 to 1855. Prof. William Morris Davis, Harvard College.
9. Some remarks on theoretical meteorology in the United States, 1855 to 1890. Prof. Frank Waldo.
10. Note concerning a bibliography of American contributions to meteorology. Oliver L. Fassig, U. S. Weather Bureau.
11. History of the Weather Map. Prof. Mark W. Harrington, Chief of U. S. Weather Bureau.
12. Brief sketch of the development of meteorology in Mexico. Rafael Aquilar y Santillan, Mexico.
13. English meteorological literature, 1337–1699. G. J. Symons, F. R. S., London.
14. Contribution to the bibliography of meteorology and terrestrial magnetism in the fifteenth, sixteenth, and seventeenth centuries. Prof. Dr. G. Hellmann, Berlin.

Section V. — Agricultural meteorology.

1. Meteorological observations considered with special reference to influence on vegetation. Prof. Dr. Paul Schreiber, Chemnitz.
2. The influence of moisture, temperature, and light conditions on the process of germination. Dr. W. Detmer, Jena.
3. Phenologic or thermal constants. Dr. Egon Ihne, Friedberg.
4. Some interrelations of climatology and horticulture. Prof. L. H. Bailey, Cornell University. Plate XI.
5. Winds injurious to vegetation and crops. Prof. George E. Curtis.
6. Droughts and famines in India. John Eliot, Meteorological Reporter for India, Calcutta. Plates XII. and XIII.

Section VI. — Atmospheric electricity and terrestrial magnetism.

1. Magnetic Survey of North America. Prof. Chas. A. Schott, U. S. Coast and Geodetic Survey.
2. Magnetic survey of Europe and Asia. Gen. Alexis de Tillo, St. Petersburg. Plate XIV.
3. The International Polar Expeditions, 1882–'83. Dr. C. Börgen, Wilhelmshaven.

4. The discovery of magnetic declination made by Christopher Columbus. Fr. Timotheus Bertelli, B[a], Florence.
5. The cosmical relations manifested in the simultaneous disturbances of the sun, the aurora, and the terrestrial magnetic field. Dr. Selim Lemström, Helsingfors. Plate XV.
6. The periodic terms in meteorology due to the rotation of the sun on its axis. Professor Frank H. Bigelow, U. S. Weather Bureau. Plates XVI–XVIII.
7. Review of recent investigations into the subject of atmospheric electricity. J. Elster and H. Geitel, Wolfenbüttel.
8. On the construction of earth-magnetic instruments. Dr. M. Th. Edelmann, Munich.
9. On some improvements in magnetic instruments. Dr. M. Eschenhagen, Berlin.
10. The present condition of mathematical analysis as applied to terrestrial magnetism. Prof. Arthur Schuster, F. R. S., Manchester. Plate XIX.
11. Methods and instruments of precision for the study of atmospheric electricity. A. B. Chauveau, Paris. Plates XX–XXV.

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PART II.